moving blades in a reaction turbine, it follows that for equal pressure drop in an element of one fixed plus one moving row the theoretical steam velocity

is only $\frac{v}{2}$ times that in a corresponding element of an impulse turbine. Therefore in a reaction turbine the blade speed to attain maximum efficiency is approximately $\frac{v}{2}$ times that of an impulse turbine designed for its maximum efficiency for equal pressure drop across one element.

Further, it will be seen that curve C shows a higher maximum efficiency than curve A. Consequently it follows that a higher blading efficiency can be attained in the case of turbines embodying the reaction principle than in the case of those designed on the impulse principle. This advantage is not necessarily reflected in the over-all efficiency of the turbine, as losses other than those due to the blading constructions have an important bearing on the over-all efficiency.

In the case of reaction turbines, the pressure drop which occurs in both fixed and moving blades involves a leakage loss which generally exceeds the corresponding loss in an impulse turbine, which occurs in the clearance space between the diaphragms and the shaft.

Where dummy pistons are used for compensating the end thrust in reaction turbines, the steam leakage past these pistons involves another loss which does not occur in an impulse turbine. As a result it has been found in practice that high efficiencies have been obtained with turbines following both principles, and no decided advantage in the matter of economy has as yet been generally recognized for turbines involving one principle of blading over the other.

CHAPTER IV

Application of Steam Turbines on Land

During the past forty years the application of steam turbines has spread with remarkable rapidity, with the result that they have very largely superseded reciprocating steam-engines in many fields.

Their success has been mainly due to low capital cost; high thermodynamic efficiency, coupled with their capacity effectively to utilize a far greater steam range than can a reciprocating engine; and high space efficiency. In addition there are many minor advantages, such as low lubrication cost, absence of oil in their condensate, evenness of turning movement, and freedom from vibration. In the matter of reliability it is obvious that a breakdown of a machine such as a turbine, where the power transmitted for a given quantity of material is out of all proportion to that handled in a low-speed reciprocator, is apt to be of a comparatively more extensive nature.

It is true that there have been numerous serious failures of turbines, but these have mostly occurred in new and untried designs, and in view of